# THE CAROLINA CHEMIST

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THE CAROLINA CHEMIST wishes to be of the greatest possible assistance to all the people of North Carolina, and since it is convinced of their active interest in industrial chemistry, it will devote practically all of its space for the next three issues to a presentation of the Raw-Materials Resources of North Carolina, from a chemist's point of view. Some space, however, will be devoted to descriptions of plants and processes already in operation. And for the convenience of the reader, the distribution of chemical factories and raw materials will be mapped. The map will be given in the December issue of this year.

## Thanks to Our Alumni

We are taking this opportunity to thank our alumni for their generous support of THE CHEMIST. We wish to assure them that we are trying to make it a worth-while journal, which will be of interest and profit to every person who reads it, and by so doing merit their faithful and continued interest in it and the Department.

To those of our alumni who have not yet sent in their subscriptions, we again wish to call attention to the fact that we need their support. It costs about fifteen cents per copy to have THE CHEMIST printed. When the cost of express, postage, typewriting, and correspondence is added to this, each copy represents an investment of about twenty cents.

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### We've Lost These

On account of the recent numerous changes of address, we have been unable to keep up with all of the alumni. If any one knows the present address of any of the following men we should be greatly obliged to receive it:

J. J. Ashbury, '00; E. F. Bohannon, '04; Chas. Bronsford, '06; L. J. Farmer, '16; R. B. Hall, '16; L. C. Hall, '16; R. Henry, '06; W. S. Hunter, '07; B. G. Klugh, '01; R. A. Lichtenthaler, '02; T. P. Nash, '10; W. S. Prior, '02; C. W. Williard,'11.

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### The Chemical Inspection Trip

Realizing the need of giving the students a close insight to industrial conditions the Department has instituted a so-called inspection trip to be held during the Easter holidays. This step has been brought about through the agency of a number of the senior and graduate students. The first trip will be held April 3d to 11th, and will consist of various plants and laboratories in Washington, D. C., Baltimore, and Philadelphia, with Philadelphia as headquarters. Dr. Bell will be in charge. It is planned now to hold such a trip each year provided a minimum number of students wish to take it. It seems as though it would be a good move to make this a requirement for graduation. We think it a very wise step, as one will naturally gain much in practical knowledge and see just how many of the theoretical principles are put in operation. More details of this trip will be given in the spring issue of The Chemist.

## The Field of Agricultural Chemistry

W. H. STROUD

In the December, 1919, issue of THE CHEMIST is found a very interesting article on Chemical Industries in North Carolina. This article, however, fails to mention the oldest and most important chemical industry in the State, namely, agriculture. For in a broader sense agriculture is more truly a chemical industry than the manufacture of cotton-seed oil, since this industry is essentially the separation of materials which nature with the farmer's aid has synthesized.

It has been truly said that chemistry is the foundation upon which the structure of modern scientific agriculture has been built. This fact is generally recognized, for there is probably no civilized country in the world today which does not have its greater or less number of Agricultural Experiment Stations. Practically all departments of these institutions use chemistry as the basis of their investigations.

Each state and territory, as well as each insular possession of the United States, has one or more such institutions. These institutions study agricultural problems relating especially to their own local conditions, although much of the work done is of broad application. For example, the Babcock Milk Tester, which was devised at the Wisconsin Station about twenty-five years ago, is used in five continents, while the recent fundamental discoveries in animal nutrition by American Agricultural Experiment Station Chemists have proven of immense importance, not only in the feeding of farm animals, but are utilized in human nutrition, especially in the diet of children.

The fields of agricultural chemistry may be divided in three parts:

1. Animal chemistry and animal nutrition.
2. Plant chemistry and plant nutrition.
3. Soil chemistry and soil fertility.

For the first two groups one should have a thorough training in organic chemistry in addition to a good general undergraduate course in chemistry as well as some training in animal and plant physiology, physiological chemistry and bacteriology. For the soil chemist, inorganic chemistry is probably first im-

portance, while some work in plant physiology, bacteriology and geology is essential.

If any undergraduates at North Carolina are considering taking advanced work in agricultural chemistry, they would find it extremely advantageous to elect biology and physiological chemistry before graduation.

As to the openings and possibiliities in this line of work it may be said that at the present time the salaries paid at the experiment stations do not compare favorably with those paid by many industrial concerns, but are more nearly comparable to the salaries paid to the teaching staffs of colleges and universities. The demand for well-trained agricultural chemists at attractive salaries in many industries is greatly in excess of the supply. Among such industries may be mentioned feed mills, fertilizer factories and milk condenseries. The demand for men especially trained in agricultural chemistry is of quite recent origin and will probably soon result in increased salaries at experiment stations.

While experiment stations have existed in this country for many years and, while many important discoveries have been made, the surface has barely been scratched, and no place offers more interesting problems than the South. It is not possible in an article like this to go into details on problems awaiting solution. Any who may be especially interested in this subject are referred to a very interesting and comprehensive article by Dr. H. J. Wheeler in the Journal of Industrial and Engineering Chemistry for November, 1919.

For one who measures success in terms of service rather than dollars and who desires a broad latitude in the selection of intensely interesting problems, no field is more attractive than that of agricultural chemical research at experiment stations.

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### Raw Materials Resources of North Carolina

It is quite certain that North Carolina will never develop great chemical industries depending on her mineral resources for raw materials. However, there will probably always be some small ore-refining plants in operation in the State because of the immense variety and wide distribution of mineral re-

sources, although none of the minerals occur in great abundance. As in the past, the operation of these plants will probably be intermittent and the output will doubtless be small since the cost of production is necessarily high on account of the low grade of the ores, and, for these reasons, a fair profit can be realized only when the finished product brings a very high price, as has recently been the case with iron, aluminium and copper.

On the other hand, the forests and fields and fisheries of North Carolina are capable of furnishing a variety of raw materials which will support a constantly increasing number and variety of gigantic chemical industries, and it is in the utilization of the materials from these sources that we shall witness the greatest application of chemical processes in our state.

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## Vegetable Oils Produced by Southern Farmers Finding Increased Favor

C. B. WILLIAMS
(Dean of Agriculture, N. C. State College of Agriculture and Engineering)

For the past few years there has been a marked increase in the consumption of vegetable oils in the United States. The main vegetable oils from the standpoint of the North Carolina and Southern farmer that are finding continued favor in this country, as well as in other parts of the world, are cotton-seed, peanut and soybean oils. The total consumption of these three oils in the United States for the first nine months of 1919 was 2,076,721,856 pounds, while the consumption of total edible animal lards was 285,777,243 pounds for the same period. This was for cotton-seed oil 5.2 times; for peanut oil 1.2 times; and for soybean oil 0.8 times the consumption of edible animal lard. Or, taking all the vegetable oils together, the consumption of these was 7.26 times the amount of edible animal lards.

For the third quarter of 1919, 58 per cent of the soybean oil, 58 per cent of the peanut oil, and 3 per cent of the linseed oil consumed in the United States was imported. Practically all of the cotton-seed oil was from cotton seed grown on Southern farms. Of course considerable soybeans and peanuts are grown

in the southern part of the United States and these are being used more and more for the production of oils.

It is interesting to note in this connection that the Southern States are the home of most of these leading crops, suitable for the production of vegetable oils for human and commercial consumption. Linseed oil is, however, an exception as it is produced mainly in the northern central section of the United States, but its production and consumption seem to be on the decrease, certainly when compared with cotton-seed, peanut and soybean oils.

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## The Vegetable Oil Industry in North Carolina

E. O. MOEHLMANN

For several years after the Civil War cotton seed was considered a nuisance. Although small quantities found use as fertilizer and stock feed, most of it accumulated in piles around the gins or was thrown into the rivers. Today the cotton-seed oil industry in North Carolina alone represents a capital stock of $22,000,000 and the forty-nine mills engaged in this business empoly 1,700 men.

The remarkable development of this industry is due largely to chemistry. The chemist has taken a waste material, and through research has developed its uses to such an extent that he can pay the farmer a good price for it and still realize considerable profit. In 1918 the cotton seed produced in North Carolina had a market value of $34,515,000, or over a third of the value of the cotton itself.

The main product derived from cotton seed is, of course, the oil. In 1918 the crop of 398,000 tons of seed yielded 16,512,000 gallons of crude oil, with a total value of $21,500,000. It is in the refining of this oil that the chemist has rendered his most important service. The refined oil is seen on the market as salad oil and mayonnaise preparations. Dissolved in light mineral oils it has taken the place of lard oil in lubricants. Recent investigations point to its use also as a lubricant for airplane engines.

To make the oil useful for lard substitutes, it is made to undergo hydrogenation, a process in which hydrogen gas is passed

through oil at a temperature of 180° in the presence of finely divided nickel. This process transforms the oil into a solid, and the lard substitutes are nearly all oil partly hardened in this manner, or mixtures of completely hardened oil with that which has not been so treated. These lard substitutes use 75 per cent of the total production.

Approximately 9 per cent is taken out as soapstock during the process of refining. From the soapstock several useful products, such as soaps, washing powders, and glycerine are manufactured. Soapstock saponified by the Twitchell process leaves a black pitch which is good for roofing paints.

Next to the oil the most important product which the manufacturing chemist gets from cotton seed is the press cake from which cotton-seed meal is made. In this state every ton of seed yields on an average 943 pounds of cake and meal which in 1918 sold for as much as $75 a ton. Here we get a glimpse of the service which chemistry has rendered, for the cake and meal from the 1918 crop was worth over $9,700,000. Much of the meal is sold to fertilizer manufacturers, to be made into fertilizers, while part of it is also used as feed for stock. Even when the latest American methods of extraction are used, the cake still contains six or seven per cent of oil; thus its food value is high. Bread made of 25 per cent cotton-seed flour, 69 per cent wheat flour, and 6 per cent potato flour has been found to contain as much strength as the best steer meat.

Still another product from cotton seed is the linters, of which North Carolina produced 67,524 bales of 500 pounds each in 1918. Chemists are finding new uses for these linters every day, and, consequently, they are gradually increasing in value. They are used extensively in the manufacture of gun-cotton, artificial water-resistant silk, tissue paper, and varnish for airplane wings.

In the hulls we again have a cotton-seed product of considerable value. Selling for around $20 a ton in 1918, the crop in this State was worth over $1,500,000. The hulls are used chiefly as cattle feed and fertilizer.

In addition to cotton seed, another source of vegetable oil is the soy bean of which considerable quantities are grown in this State. The Elizabeth City Oil and Fertilizer Company, of Eliza-

beth City, N. C., was the first company in the United States to manufacture soy-bean oil and meal from domestic soy beans. This was in 1915, and now, since the same machinery can be used with little adjustment for soy beans, at least ten of the cotton oil companies in the State are pressing soybeans also.

Unlike cotton seed, the most valuable product of the soy bean is the meal rather than the oil. As a fertilizer this meal is richer than cotton-seed meal. It contains on an average 7.48 per cent nitrogen, 14 per cent phosphoric acid, and 1.83 per cent potash. As feed for cattle it is also very nutritious and does not contain the toxic substance that is present in cotton-seed meal. As a human food soy-bean meal has great possibilities. From it are made macaroni, cheese, coffee substitutes, and flour which is very rich in protein and mineral matter.

The oil from soy beans constitutes from 17 to 20 per cent of the beans, is practically neutral, and most of it is saponifiable. Being of a semi-drying nature it is used together with linseed oil in the manufacture of paints, varnishes, and enamels. After the oil has been subjected to hydrogenation it may even replace linseed oil altogether as a dryer, and in this respect it is superior to cotton-seed oil. In the manufacture of soaps, linoleums, and water-proofing materials, soy-bean oil is used extensively, and shows promise of development in various ways. It may be refined like cotton-seed oil and then it may be used as an edible oil, or converted into lard and butter substitutes.

Nor are these the only sources from which the state may obtain large quantities of vegetable oil. At present North Carolina produces great quantities of peanuts in the eastern part of the state, and is capable of producing still larger quantities when necessity shall require them. By subjecting the peanut to practically the same treatment as cotton seed and soy beans are during pressing, an oil is obtained which, after being refined, is very similar to cotton-seed and soy-bean oil and may be used instead of them.

An account of the rapid spread of the boll weevil the cotton crop will without a doubt become a more uncertain crop in the future. Consequently more peanuts and soy beans are going to be grown, since they both thrive where cotton does. Therefore

these two crops are going to become more important sources of the state's vegetable oil supply in the future than they have been in the past.

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## Wallace Fisheries Company

The fish oil industry is one of considerable importance along the North Carolina coast. In 1914 there were fourteen factories engaged in the fish oil and fish scrap industry. The Wallace Fisheries Company, of Morehead City, N. C., is typical of the industry, and this article will be devoted chiefly to this plant.

The fish-oil industry was established in the county about forty years ago. At that time, and up to about five years ago, the fish were cooked in open vats, and then pressed to extract the oil and prepare the scrap for drying. In recent years practically all of the large manufacturers have installed modern machinery for the cooking and pressing. The fish are cooked by steam while passing through a cylinder sixty feet in length and eighteen inches in diameter. They then drop into a "screw press" and the oil and water are pressed out. Then they pass into a dryer forty feet long by five and one-half feet in diameter, after which the oil and scrap are ready for shipment.

After passing through this process of cooking and pressing the scrap is fine enough to pass through the fertilizer distributer and is sold to the fertilizer companies. The oil extract is sold in its crude state. It is generally graded as follows: Extra bleached winter fish oil, bleached winter fish oil, light winter pressed fish oil and brown winter pressed fish oil. It varies from a very high grade clear amber color to dark brown, depending chiefly on the condition of the fish when reaching the factory.

Fish oil is used in paints, varnishes, the tempering of steel and to some extent in tanning. During the war a good percentage of glycerine was extracted from it. The price is regulated largely by its content of fatty acid, the present market being nine-two cents per gallon under five per cent fatty acid.

The average price of fish scrap during the past three years has been around $75 per ton. It averages around 10½% ammonia and is sold on the ammonia basis, it being estimated

that 95% of the product is bought by the fertilizer companies and made into various grades of fertilizer.

Every plant has its own fishing boats and depends upon the catch in the ocean. The average value of the plants in the county, including fishing boats and seines will run around $100,000 each. There are ten such plants and three smaller ones with a capitalization of about $50,000 each. The fish move north about April and return in the fall. In the spring they are very poor and yield very little oil but return south in the fall and are very fat.

At present none of the plants employ chemists. It is presumed that their products are sold in bulk without any strict specifications. Naturally this is to the disadvantage of the producer, especially when his products are being sold to the larger companies where every tenth of a per cent means hundreds of dollars. The products are analyzed and he knows exactly what he is getting, while the plants that have no methods of knowing can only sell their products for the price offered.

It is highly probable that a very interesting and profitable number of products could be obtained from the fish oils. Little is known of them and it appears that investigations have not been carried very far. The companies have been content to dispose of their products in the raw state just as the turpentine interests have done. What we would like to see is a greater interest in manufactured products here at home. Such an industry can be built up, and with proper chemical control and investigation we feel that the manufacturers of fish oil and fish scrap could reap far greater profits than is now possible.

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## Gold

The production of gold in North Carolina has continuously been on the decline since 1906. According to the reports of the North Carolina Geological and Economic Survey this is the result more of inefficient management and inadequate financing than of the lack of ore. Gold is found in some sixteen counties of the state, while the largest producers are Montgomery, Rowan, Catawba, Randolph, and Union counties. Montgomery

has led in the production for many years, the principal mine being near Candor, N. C.

The general processes in use are the cyanide and amalgamation, the cyanide process being largely used in Randolph county and the amalgamation process in Union county. For details concerning the methods of mining one should consult the North Carolina Geological and Economic Survey.

The Catawba mine has been worked only in open cuts by steam shovel, conveyors, and washers, the yield of gold being considerable.

Gold mining was practically at a standstill in 1918, only a small amount being produced and that mainly from the dumps of old mines.

## Copper

The amount of copper produced at present is small; yet there are a large number of copper deposits of wide diversity of character that apparently could be worked profitably. The copper obtained from the Ore Knob mine in Alleghany county is exceedingly pure and is approached by no other on the market except that from the Lake region. It resembles very much the ore of the famous Duchtown, Tenn., deposits, being, however, more siliceous.

An analysis shows the following:

| | 1 | 2 | 3 |
|---|---|---|---|
| Residue | 29.10 | 13.57 | 12.80 |
| Chalcopyrite | 11.33 | 13.50 | 4.76 |
| Pyrrhotite | 37.46 | 35.74 | 48.78 |
| Sesquioxide of Iron | 8.14 | 16.34 | 18.36 |
| Aluminum | 1.84 | 1.49 | |
| Manganese | .16 | .50 | .76 |
| Lime | 5.32 | 7.84 | 7.21 |
| Magnesia | .35 | .94 | .30 |
| Carbonic Acid | 4.76 | 7.19 | 6.00 |
| Zinc | .67 | .66 | .65 |
| Cobalt | .09 | .09 | .095 |
| Nickel | .71 | .92 | 1.08 |
| Alkalies, etc. | | | |
| Undetermined | | | |
| | 99.93 | 98.58 | 100.79 |
| Metallic Copper in ore | 3.92 | 4.60 | 1.65 |

No 1. Sample of 13 buckets of ore, 1,800 pounds each, from high slopes.

No. 2. Sample of 16 buckets of ore, 1,600 pounds each, from engine shaft.

No. 3. Sample made by taking a wheelbarrow load from each pile of the pure ore on surface, the material being quartered down for assay.

The Gap Creek or Copper Knob mines are situated in the valley of Gap Creek a few miles west of the Blue Ridge. The ore occurs in well-defined quartz veins and consists of chalcopyrite and bornite, the concentrates carrying between $50 and $60 in gold.

The Peach-Bottom mines lie on the west slope of the Alleghany mountains in Ashe county, seven miles from New River. The ore is extremely siliceous, and the particles of pyrite are small, irregular, and closely interlocked with the quartz. Hence exceedingly fine crushing is necessary. This deposit is not considered a valuable one.

There is considerable ore in Jackson and Macon counties. The ore consists of chalcopyrite, glaucer, and gray copper, with the common decomposition products near the surface.

In Davidson and Rowan counties many gold veins are the copper bearing ore deposits, the sulphide ores containing from two to five per cent copper present as the chalcopyrite. These properties are being extensively opened and exploited.

## Iron

There are very large deposits of iron ore in North Carolina, some deposits containing an ore which makes an exceptional grade of iron. The deposit at Cranberry, Avery county, is by far the most famous and has been worked contniuously since 1876. This is a magnetic ore, which is distributed in irregular masses through the gangue, composed of hornblende, pyroxene, epidote, quartz, feldspar, calcite, garnet, serpentine, etc., in varying proportions. These deposits are adapted to pig iron at a low cost. Similar deposits occur in Ashe county.

## Graphite

Very little graphite is produced in this state, due to the uncertain methods of mining, and foreign competition. Practically all of North Carolina's production comes from Wake county.

### Dolomite, Marble, Marl and Limestone

Dolomite, having the theoretical composition $CaMg(Co_3)_2$. is not found in abundance in North Carolina. However, deposits occur at the Hiddenite mine in Alexander county, which were thought to be the best in the United States. This has not, however, been substantiated by more recent investigation. Dolomite found was clear and glassy, and varied in color, from white to pale brown to purple. The dolomite found here could be used as refractory linings of converters in basic steel process.

Marble is a metamorphosed limestone, usually containing grains of calcite. The largest deposit in the state is found at Regal and Kinsy in Cherokee county. Although this marble is used primarily as a building stone, the cheaper grades are sent to Tennessee Copper Co., to be used as a flux in ore refining. The deposit of Mantahala marble in Swain county is of poor quality. It is at present used as a source of lime for paper mills.

Marl is a loose earthy carbonate mixed with clay. Its chief chemical interest lies in the readily available CaO that it contains. Most of the eastern counties contain quantities of this material, which is suitable for agricultural lime. A large deposit is exposed in the northwestern edge of Wake county. Greensand marl as found in upper and lower Blackrock, on the Cape Fear, contains 11.4 to 33.4 $CaCo_3$ and .38 to 1.43% potassium. Several samples of this variety from along the Tar River, near Tarboro, contains 1.75 potassium. Although the Greensand marl is the most available for fertilizer, the Eocene marl contains the most CaO, which could be converted by simple treatment into a valuable fertilizer. Samples of this marl analyzed contained 40 to 80% $CaCO_3$.

Limestones are carbonates of calcium usually mixed with calcite or dolomite. They often contain as impurities certain clays, which may be converted into a cement that hardens rapidly under water. It is also interesting to notice that in the eastern counties, especially in New Hanover, there is an impure limestone which possesses fine possibilities for use in manufacture of a Portland cement. Although pure deposits of limestone are rare, impure forms are found in abundance.

which can be easily converted into CaO. Quantities of the mineral, several miles thick, are found in Cherokee county. The limestone in this section is, however, mixed with slates of several varieties. Henderson, Madison, Craven, and Wake counties all contain quantities of this mineral which are suitable for the production of lime. This burning of limestones to make fertilizers and limes is one of our oldest industries. As far back as 1860 the process was well developed, and several kilns near the Crane Creek and Toxoway bed were converting the native mineral into CaO. Deposits found in our southeastern counties are mixed with clay and resemble marl. However, along the northeast Cape Fear and Trent Rivers, the mineral appears as a sort of shell rock, which is covered with one to five feet of earth, and often contains nodules of phosphates of lime.

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## Water Power in North Carolina

One of the chief natural resources of North Carolina is her water power. Only in recent years have any considerable developments been made along this line, and only a small percentage of the available water power has been developed. Water power is by far the cheapest source and the most abundant supply of energy in the state.

In the Piedmont and mountain sections, where most of this energy is going to waste at present, there are numerous ideal locations for hydroelectric developments. No estimate could be obtained as to the total amount of available power in the state, since topographic features have not been worked out. I do not think, however, it is an absurdity to say that the water power in this state, if developed, would more than run every manufacturing plant, every street railway, and furnish lights for every town in the state.

For more than half a century small developments have been made throughout the state in harnessing this power to drive flour mills, saw mills, grist mills, textile plants, etc. With the developments in electricity the developments in water power also increased. Efficiency in transmission enables

power to be transferred from the turbo-electric generator to the factory wheels many miles away, at a very small loss.

Chief among the developments in this state have been those of the Southern Power Co. Energy furnished by this company drives over four million spindles in 300 textile plants in the two Carolinas. The Southern Power Co. has 350,000 horse-power of hydro-electric power plants in the two states, the annual output from which is equivalent to the burning of one million tons of coal.

It is true, however, that only a small per cent of the available power has been developed. It is a well-known fact also that electrical energy is necessary in most of the chemical industries of today. Since we are in the beginning of a period of great progress in chemical developments in this country it seems only reasonable to predict that our state will come to the front and be among the leaders in the southern states in the manufacturing of substances involving chemical processes. The great supply of raw materials necessary in many industries, including the agricultural products, the forest products, and a few mineral resources, are at our door; and with an abundance of water power, the cheapest power in the world, a great future is possible and probable for the chemical industries of North Carolina.

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## Coal in North Carolina

For a long time it has been a well-known fact that there are minor coal deposits in North Carolina. These fields have not been developed commercially, however, because of a greater supply of cheaper coal in other regions. They were worked quite extensively during the Civil War, but were abandoned because at that time with few industries in the south there was no demand for North Carolina coal.

The principal beds are found in the Deep River area in Chatham and Moore counties. They extend northeast and southwest, over a length of 30 or 40 miles, and varying in width from a few miles up to 18 miles. The thickness varies from 2 to 6 feet, and the total area covered in North Carolina is estimated at 300 square miles.

The coal is of the bituminous variety and is a good quality of coal. It is well adapted for fuel, cooking, gas, etc. Analysis shows 60 to 65% fixed carbon with about 15% volatile carbon. It contains little sulphur, and is superior in quality to some of the middle-western commercial coals. Tests have been made on gas producing from these coals, and have shown a favorable quality and yield of gas.

Although the Deep River coal beds are relatively thin and deep underground, the amount of available coal in the area is estimated at more than one thousand million tons. The beds are in a locality favorable to the development of chemical industries. Numerous mineral resources and forest products are available for raw materials, for chemical, lumber, textile, and other industries. Many manufacturing towns in the near vicinity would furnish a market for gas, and since the coke is of a good variety there is a possibility of developing the nearby iron-ore deposits.

The one drawback now which prevents this area from being developed commercially, is the great depth and thinness of the beds, which increase the cost of mining. As manufacturing in the south develops, and as the demand for coal increases, it is very probable that the Deep River area in the future will be a commercial coal field.

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## Mining of Monazite in Catawba and Lincoln Counties, Western Carolina

M. C. YODER

Minute quantities of monazite occur in the soil over wide areas in these counties, but it is only in places where the lighter sand and soil have been carried away by running water, allowing the heavier monazite to settle into beds, called "gravel beds," that mining can be carried on profitably. From this description it is readily seen that the process is one of surface mining.

The only equipment necessary is a triangle made of wood about ten feet long, eighteen inches wide, and twelve inches deep, with one open end; a perforated iron plate about two

feet long the same width as the trough, and a few picks and shovels.

The trough is placed with the closed end about four inches higher than the open end. The perforated plate is placed in an almost horizontal position above the closed end of the trough. A stream of water must be brought down from a higher source and made to fall upon the perforated plate. The miner is then ready to begin operations.

The beds of gravel are dug up and shoveled upon the perforated plate. All the monazite, along with the fine sand, is washed into the trough. The coarser gravels are thrown off with a shovel. This is continued until the large trough is filled with sand containing the monazite. Then the miner is ready to start the process called "washing" the monazite.

The perforated plate is removed and the water is permitted to fall directly into the upper end of the trough. This gives the water that must flow continuously over the mixture of sand and monazite during the washing process. The mixture is then stirred with a shovel, the movement being toward the upper end of the trough at all times. The lighter material is swept away by the running water while the heavier monazite gradually settles toward the bottom of the trough.

This process is continued until all the white sand is washed away and a mixture of monazite and black sand is obtained. A very large percentage of the mixture is black sand which cannot be removed by further washing. The product is drained for a while and then spread upon canvas cloth in the sun to dry. After drying, it is packed in strong canvas bags, and sent to market still containing its high percentage of black sand.

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## Some Other Minerals

(This is by no means a complete list)

Below are given a description and the approximate production and value of a few of the most valuable minerals which we have in North Carolina. There is a larger variety of minerals located in this state than in any other state in the Union. It is true that a few of these minerals appear

only in small deposits, but most of them are in deposits large enough to be mined commercially at a very good profit. We have the raw products in the mines, all of the necessary materials for refining, good supplies of water power, and there is no reason at all why we should have to send our raw mined products to other states for manufacture.

### PRECIOUS STONES

A number of kinds of precious stones are produced in North Carolina every year. Some of the most important stones mined in the state are: beryl, from Macon county; emerald, from Cleveland county; ruby and sapphire, from Macon and Transylvania counties; also diamonds, opals, and garnets have been found. Very little work has been done in mining these gems, as most of them are gotten from the surface of the ground, and prospecting in these localities might result in the discovery of valuable pockets of these gems. In 1912 precious stones were marketed to the value of $5,655.

### MONAZITE

Monazite, which is anhydrous phosphate of cerium, praseodymium, neodymium, and tantalum, also has thoria and silica present in small amounts. This mineral is used commercially in the manufacture of mantles for gas lighting. It is found chiefly in the western part of the state. Monazite has been tested as to its radio activity by Bottwood, of Yale University, and a sample from this state contained 5 per cent thoria and 0.43 per cent uranium. Dr. Bottwood proved that the radio activity of monazite is due to its uranium content. In a pegmatic dike in Madison county, rough crystals of monazite 1.5 inches in length have been found. Cerium oxalate, which is gotten from monazite, is used by druggists. Monazite deposits of commercial value chiefly within the Piedmont region of North and South Carolina, and most all of the mineral produced, is mined from placers. The production of monazite in this state during 1908, 1909, and 1910, amounted to 785,264 pounds, valued at $94,256. From 1910 up to the present day the production of monazite has steadily increased, due to the pressing demand for it commercially, and for scientific research.

### TALC AND PYROPHYLLITE

Talc and pyrophyllite are very important minerals, which are used in the manufacture of pencils, electric insulators, gas tubes, etc. North Carolina has a large supply of these minerals, occurring mostly in Cherokee, Graham, Swain, Jackson, Ashe, and Alleghany counties. We have two kinds of commercial talc: the pure talc, which is a hydrous magnesium silicate, and another talc called pyrophyllite, which is a hydrous aluminium silicate. The production of both kinds in North Carolina in 1912 was 3,542 tons, valued at $63,304. Since that time the production has been more than doubled. If talc were mined on a really large scale, it would be found very profitable.

### KAOLIN

Kaolin, which is a white-burning, residual, primary clay, varies very widely in its chemical and physical properties, depending upon the rock of which it was a disintegration product. Its chemical composition is usually $Al_2O_3.2SiO_2.2H_2O$. It is used in the manufacture of high-grade tiling, porcelains ware, for enameling of brick, and in numerous other products. There are two methods of mining this mineral. First, we have the open cut method, which is as follows: The wall rock on the lower side is removed to the lowest workable depth of the deposit, thus exposing the dike from top to bottom. The second method is shaft mining. Sometimes the two methods are combined. The most expensive item in the cost of mining kaolin is the removal of water from the mine. After being mined, the kaolin is ground very finely, washed, and dried. The North Carolina deposits are mostly in Mitchell, Macon, Jackson, and Swain counties. The kaolin gotten from these counties, upon analysis, proves to be equal in quality to the best in the country. Practically all of our kaolin is shipped out of the state to be manufactured. Why do we not begin to manufacture kaolin products ourselves? The production of kaolin in North Carolina in 1912 was 14,950 tons, valued at $109,717. The production has increased enormously since that date.

## THE HIGH SCHOOL DEPARTMENT

Since the date of publishing THE CHEMIST has been changed, we will not be able to report the results of the examinations until the May issue. At that time, however, we will announce the name of the winner, and the name of the school, and also the name of the principal of the school.

Since so many of the high schools are planning to install chemical laboratories, THE CHEMIST wishes to say that it will be glad to render any assistance possible in selecting the equipment and in designing such laboratories.

There is another way in which THE CHEMIST can serve the schools in a very substantial manner, viz.: in purchasing laboratory equipment and supplies. Briefly, the plan is as follows: The schools will make out lists of supplies needed for the next school year and mail them to THE CAROLINA CHEMIST not later than April 10th next. They should also state when the goods shall be shipped from the factory. We will then obtain bids on the whole lot, f. o. b. cars at the point of shipment, from the several chemical apparatus factories. The factory making the best bid on the lot will be instructed to ship the several orders direct to the schools with the bills of lading attached.

By purchasing in such a large quantity, we believe each school will save 25% or 30% on its laboratory supplies. If you are interested in this plan of purchasing supplies, let us have your list of equipment and supplies for your next school year on or before April 10th, as we cannot handle them after that date.

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### Chemical Fun

The following is suggested as a fair examination of both practical and theoretical knowledge of "Chemistry 192."

Synthesis of tetra Methyl Nitro Amino Oxy Chlorbenzol. Substances necessary: Sodium, hydrogen ions, cathode rays, radium green, T. N. T.

Apparatus: 1 stirring rod, 1 match.

Procedure (to be followed with extreme carelessness): Select several choice medium-sized hydrogen ions from a bottle and scour until thoroughly clean. Wipe and dry carefully. Avoid handling. Lay aside. Now soak a few large chunks of metallic sodium in a beaker of distilled water and allow to stand quietly. In the meantime be collecting a pailful of cathode rays. Filter these, using suction. Beat them to froth with two and three-quarter pounds of green radium (the red variety is highly unsuitable for this experiment). Now stir in the hydrogen ions one at a time. Drain the sodium and put it into the above mixture. Grind up with T. N. T. and put in a mortar and add all at once. Thus the reaction will become catalyzed. Yield ½.

Questions:

1. Write all the reactions not involved.

2. What would happen if the apparatus were changed from a stirring rod and a match to a gas tap? Write the reaction.

4. Why not use red radium? If so, how?

5. Are you certain? When?

6. How would you prepare the sodium from a piece of copper wire? Why?

7. Reactions?

8. State the law of supply and demand.

9. What made you say it applied here? You knew it didn't.

10. Give in detail what this experiment taught you. Why not?

—*Voodoo*, M. I. T.

## STATUS LYMPHATICUS

We are dispersoids,
But as emulsoids,
Meld with environment,
Basicly fit.

None are suspensoids
In the state colloid,
All are contiguous,
Doing our bit.

Means of dispersion,
Systems coersion,
Change in reaction,
Flocculates out.

Do we suspicion,
Future condition,
All as precipitates,
Is there a doubt?
—*The Chemist Analyst.*

---

Why is Boyle's law like love?
The lower the gas, the higher the pressure.
—*The Percolator.*

---

## CHANGE

Ruth is an alchemist, I know,
And so I'll have to drop her,
For every time I'm out with her
My silver turns to copper.
—*Widow.*

*Essie Brothers*

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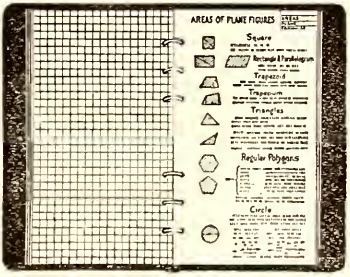


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